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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of :

Nicole SCHOEDEL et al.

Serial No.: 09/931,177 Group Art Unit: 1764

Filed: August 17, 2001 Examiner: Thanh P. Duong

For: REACTOR FOR PERFORMING A STRONGLY HEAT-CONDITIONED CATALYTIC REACTION

BRIEF ON APPEAL UNDER 37 C.F.R. § 41.37

MAIL STOP APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
ALEXANDRIA, VA 22313-1450

Sir:

Further to the Notice of Appeal filed June 27, 2005, attached herewith is Appellants' Brief on Appeal. Pursuant to 37 CFR § 41.20(b)(2), attached is a check for $620 for the filing of this Brief, and for a one month extension of time.

This is an appeal from the decision of the Examiner finally rejecting claims 1, 3-10, and 25-35.

(1) REAL PARTY IN INTEREST

The application is assigned of record to Linde AG of Wiesbaden, Germany, who is the real party in interest herein. The assignment is recorded at Reel 012321/Frame 0957.

(2) RELATED APPEALS AND INTERFERENCES

Appellants, their legal representative and the assignee are not aware of any related appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the instant appeal.

(3) STATUS OF THE CLAIMS

Claims rejected: 1, 3-10, and 25-35;

Claims allowed: None;

Claims canceled: 2 and 11-24;

Claims withdrawn: None;

Claims objected to: None;

Claims on Appeal: claims 1, 3-10, and 25-35. A copy of the claims on appeal is provided in the attached Claim Appendix.

(4) STATUS OF AMENDMENTS AFTER FINAL

On May 25, 2005 Appellants filed a Reply under 37 CFR §1.116. However, this Reply did not include any amendments.

(5) SUMMARY OF THE CLAIMED SUBJETC MATTER

Appellants' invention is directed to a reactor, particularly a reactor for performing a heat-conditioned catalytic reaction in a process fluid. The reactor comprises plates, arranged parallel to one another at a distance, that form flat channels with lateral boundary areas that face one another. A portion of these channels contain a solid catalyst and carry a process fluid. Another portion of the channels carry a heat transfer medium which is in indirect heat contact with the process fluid. The plates are flat or are provided with grooves or ribs and are coated at least partially with a catalyst on the surface that faces the process fluid. See, e.g., page 4, lines 14-24 and independent claims 1 and 32.

According to another aspect of the invention, the reactor comprises plates, arranged parallel to one another at a distance, that form flat channels with lateral boundary areas that face one another. A portion of these channels contain a solid catalyst and is in fluid communication with a source of process fluid. Another portion of the channels is in fluid communication with a source of a heat transfer medium which is in indirect heat contact with the process fluid. The plates are flat or are provided with grooves or ribs and are coated at least partially with a catalyst on the surface that faces the process fluid. See, e.g., page 4, lines 14-24 and independent claim 34.

According to one aspect of the invention, the lateral boundary areas are jacket pieces. These jacket pieces form a pressure-resistant cuboid block with the channels and plates, and with collectors for the process fluid and for the heat transfer medium. The reactor is capable of operating at process fluid and heat transfer medium pressures of more than 25 bar. See, e.g., page 5, lines 11-19 and independent claims 1, 32 and 34.

(6) GROUNDS OF REJECTION TO BE REVIWED ON APPEAL

The grounds of rejections that are on Appeal are:

(1) whether claims 1, 5-10, 26-29 and 32-35 of the application are unpatentable under 35 U.S.C. §103 as being obvious in view of the disclosure of Romatier et al. (US 6,168,765); and

(2) whether claims 3, 4, 25, 30, and 31 of the application are unpatentable under 35 U.S.C. §103 as being obvious in view of the disclosure of Romatier et al. (US 6,168,765) in combination with the disclosure of Van Dyke et al. (US 5,031,693).

(7) APPELLANTS' ARGUMENTS

Rejection under 35 USC §103(a) in view of Romantier et al. (US '765)

Claims 1, 5-10, 26-29 and 32-35 are rejected as allegedly being obvious in view of Romatier et al. (US 6,168,765).

Romatier et al. (US '765) discloses a plate reactor arrangement for contacting reactants with a catalyst in a reaction zone and providing indirect heat exchange between the reactants in the reaction zone and a heat exchange fluid. The reactor comprises a plurality of spaced apart plates which define a first plurality of reaction channels and a second plurality of reaction channels. A catalyst material is retained in at least one of these plurality of channels. The reactor further comprises a manifold which is in direct communication with the outlets of the first plurality of reaction channels and with the inlets of the second plurality of reaction channels. This manifold further includes an injector for injecting a fluid into the manifold to mix with fluid from first plurality of reaction channels, the resultant mixture being then fed

into the second plurality of reaction channels. See, e.g., column 4, line 62 - column 5, line 12.

As the reactant-containing stream is passed through the plurality of channels, it is subjected to indirect heat exchange with exchange fluid which passes through another plurality of channels, also defined by spaced apart plates. See, e.g., column 5, lines 12-18.

The plates used in the reactor arrangement can be perforated. They can also be corrugated. See column 3, lines 37-67. See also the embodiments illustrated in Figures 2 and 3.

In the arrangement shown in Figure 1, the reactor has a distribution chamber 14, a first set of reaction channels 15, a manifold 18 with pipe lance injector 21, a second set of reaction channels 23, a collection chamber 26, and a set of heat exchange channels 16. Reactant enters through inlet 13, passes into the distribution chamber 14, and then passes laterally through the reactor via the first set of reaction channels 15 which contain an oxidation catalyst. Manifold 18 collects the reactant from channels 15, combines it with additional reactant from injector 21, and distributes it into the second set of reaction channels 23 through which, again, the reactant flows laterally. The effluent is then delivered to collection chamber 26 and removed there from via outlet 12.

As the reactant flows laterally through reaction channels 15 and 23, a cooling fluid flows longitudinally through a plurality of heat exchange channels 16, thereby establishing a cross flow relationship. Thus, in general, in Figure 1 the reactant flows laterally from distributors to collectors while the heat exchange fluid flows longitudinally.

In the embodiments in Figures 4-8, both the reactant and heat exchange streams flow laterally. Thus, the lateral sides of the plate reactor are provided with distributors and collectors. See, for example, in Figure 4, collection chamber 49, outlet chamber 51, inlet chamber 53, and collection chamber 50 for the reactant, and distribution sub-channels 62 and collection sub-channels 63 for the cooling fluid. In other words, the lateral areas of the reactor embodiments disclosed by US '765 are where distributors/collectors are connected, not jacket pieces as recited in appellants ' claims 1, 32 and 34.

Comparing the disclosure of US '765 to the claimed invention, US '765 does not suggest a plate reactor which can operate at high pressures. Appellants' claims recite that the reactor has lateral boundary areas which are jacket pieces, and that these jacket pieces,

together with the channels, plates, and collectors, form a pressure-resistant cuboid block, whereby the reactor is capable of operating at process fluid and heat transfer medium pressures of more than 25 bar.

In the rejection it is alleged that it would be obvious to design the reactor of US '765 to be capable of operating at pressures of more than 25 bar in order to meet pressure vessel requirements. However, this assertion does not present any motivation for modifying the reactor. No rationale is presented as to why one of ordinary skill in the art would modify the reactor so as to meet pressure vessel requirements to be capable of operating at pressures above 25 bar. The mere ability to modify a disclosure, by itself, does not establish obviousness. Instead, there most be some motivation that would lead one of ordinary skill in the art to make the asserted modification. See, e.g., *In re Laskowski.,* 871 F.2d 115, 10 USPQ2d 1397 (Fed. Cir. 1989).

In the Advisory Action issued June 30, 2005, the Examiner argues that it would be obvious to manufacture the reactor of US '765 so as to operate at above 25 bar because: "Romantier et al. discloses reactor with the same structure as the claimed invention"; and discloses stainless steel as a plate material. But, as noted above, the reactor embodiments of US '765 are not the same structure as recited in appellants' claims. The lateral areas of the reactor embodiments disclosed by US '765 are distributors/collectors, not jacket pieces. Thus, US '765 provides no disclosure or suggestion of lateral boundary areas that are jacket pieces, and which form a pressure-resistant cuboid block together with channels, plates, and collectors.

Furthermore, in accordance with the state of the art, the manufacture of a catalytic reactor as described by US '765 would involve first coating the plates with a catalytic film and then connecting the various components together to form the plate reactor. However, one would not combine these components together by such means as welding or brazing since these operations could damage the catalytic film. Without such positive connection of the components by welding or the like, the reactor would not be expected to operate at pressures of greater than 25 bar.

It is noted that US '765, in discussing the passage of heated reactants through a common chamber, indicates the desirability of eliminating the need for providing manifolding and its associated welding at one end of the reactor. See column 3, lines 33-37. The

Examiner cites to this disclosure in the Advisory Action. However, the Examiner provides no explanation as to how this disclosure, suggesting the desirability of eliminating welding, would suggest to one of ordinary skill in the art to connect the reactor components together by welding, such that the reactor would be expected to operate at pressures of greater than 25 bar, particularly since welding could damage the catalytic film.

In view of the above remarks, it is respectfully submitted that US '765 fails to render obvious appellants' claimed invention.

Claim 6

In the rejection, the Examiner argues that "it is conventional to provide a support medium and/or metal carrier for the catalyst layer and it would have been to do so here." See January 25, 2005 Office Action, page 3. This, however, is merely a conclusion. Even if using a catalyst support would be obvious in certain situations, the rejection presents no rationale as to why it would be obvious in the present situation. Nor does the Examiner present any motivation that would lead one of ordinary to modify the reactor of US '765 in such a manner. For example, the use of a support for the catalyst layer could lead to undesirable restriction of the flow passage.

In view of the above remarks, it is respectfully submitted that US '765 fails to render obvious the subject matter of appellants' claim 6.

Claims 7, 8, and 29

Claims 7 and 29 recite that the catalyst layer has a thickness of 1-500 μm. Claim 8 recites that the catalyst layer has a thickness of 10-100 μm. In the rejection the Examiner alleges that it "is conventional to provide a catalyst layer with such thickness ranges to ensure optimum catalytic activity is obtained." See January 25, 2005 Office Action, page 3. Here again, this is a conclusion. Nothing suggests that such a thickness range would be optimal for the reactor of US '765. In addition, the Examiner's reference to the disclosure of US '945 (See January 25, 2005 Office Action, page 3) does not demonstrate the requisite motivation to modify the disclosure of US '765 so as to employ a catalyst layer having a thickness of 1-500 μm.

In view of the above remarks, it is respectfully submitted that US '765 fails to render obvious the subject matter of appellants' claims 7, 8, and 29.

Claims 25 and 26

Claims 25 and 26 each recite that the width of the passages for the flow of process fluid is 0.5-5 mm. In the rejection, the Examiner asserts that "Romantier discloses the width of the process channel of 0.5-5mm (Col. 8, lines 16-16) and distance between plates of 2.5-20 mm." See January 25, 2005 Office Action, page 4. The relevant portion of the disclosure of US '765 (column 8, lines 12-18) is as follows:

> In general, the invention relies on relatively narrow channels to provide the efficient heat exchange across the thin plates. In general, the channel width should be less than one inch on average with an average width of less than 1/2 inch preferred. Suitable plates for this invention will comprise any plates that allow a high heat transfer rate. Thin plates are preferred and usually have a thickness of from 1 to 2 mm.

Contrary to the assertion in the rejection, this portion of the disclosure does not suggest a passage width for the flow of process fluid of 0.5-5 mm. In view of the above remarks, it is respectfully submitted that US '765 fails to render obvious the subject matter of appellants' claims 25 and 26.

Claims 27 and 28

Claims 27 and 28 each recite that the distance between plates, not taking into account the catalyst, is 2.5-20 mm. In the rejection, the Examiner asserts that "Romantier discloses the width of the process channel of 0.5-5mm (Col. 8, lines 16-16) and distance between plates of 2.5-20 mm." See January 25, 2005 Office Action, page 4. The relevant portion of the disclosure of US '765 (column 8, lines 12-18) is as follows:

> In general, the invention relies on relatively narrow channels to provide the efficient heat exchange across the thin plates. In general, the channel width should be less than one inch on average with an average width of less than 1/2 inch preferred. Suitable plates for this invention will comprise any plates that

allow a high heat transfer rate. Thin plates are preferred and usually have a thickness of from 1 to 2 mm.

Contrary to the assertion in the rejection, this portion of the disclosure does not suggest that the distance between plates, not taking into account the catalyst, is 2.5-20 mm. In view of the above remarks, it is respectfully submitted that US '765 fails to render obvious the subject matter of appellants' claims 27 and 28.

Rejection under 35 USC §103(a) in view of Romantier et al. and Van Dyke et al.

Claims 3, 4, 25, 30, and 31 are rejected as allegedly being obvious in view of Romantier et al. (US 6,168,765) in combination with Van Dyke et al. (US 5,031,693). This rejection is also respectfully traversed.

In the rejection, US '693 is relied on for its disclosure of using corrugated perforated plates. See January 25, 2005 Office Action, page 4. However, US '693 does not overcome the deficiencies discussed above with regards to the disclosure of US '765. Thus, there is no motivation presented in the rejection that would lead one of ordinary skill in the art to modify the plate reactor of US '765 so as to employ a pressure-resistant cuboid block formed from jacket pieces, channels, plates, and collectors, to provide a reactor capable of operating at process fluid and heat transfer medium pressures of more than 25 bar.

In view of the above remarks, it is respectfully submitted that US '765, alone or in combination with US '693, fails to render obvious appellants' claimed invention.

(8) CONCLUSION

For all of the above reasons, it is urged that the decision of the Examiner rejecting claims 1, 3-10, and 25-35, on appeal, is in error and should be reversed.

Respectfully submitted,

Brion Heaney
Registration No. 32,542

Filed: September 27, 2005

CLAIMS APPENDIX

Listing of Claims:

1. (Previously Presented): A reactor for performing a heat-conditioned catalytic reaction in a process fluid, said reactor comprising: plates that are arranged parallel to one another at a distance and that form flat channels with lateral boundary areas that face one another, wherein a portion of said channels contain a solid catalyst and carry a process fluid, and another portion of said channels carry a heat transfer medium in indirect heat contact with the process fluid, wherein said plates are flat or are provided with grooves or ribs and are coated at least partially with a catalyst on the surface that faces the process fluid, and

wherein said lateral boundary areas are jacket pieces, which form a pressure-resistant cuboid block with said channels, plates, and with collectors for the process fluid and for the heat transfer medium, and said reactor is capable of operating at process fluid and heat transfer medium pressures of more than 25 bar.

2. (Cancelled):

3. (Original): A reactor according to claim 1, wherein the channels which carry the process fluid contain corrugated or pleated sheets which form passages for the flow of process fluid.

4. (Original): A reactor according to claim 3, wherein said sheets are perforated and thereby provide flow connections between said passages.

5. (Original): A reactor according to claim 3, wherein said sheets are coated at least partially on both sides with catalyst material.

6. (Original): A reactor according to claim 1, wherein said catalyst layer contains a support medium.

7. (Original): A reactor according to claim 1, wherein said catalyst layer has a thickness of 1-500 μm.

8. (Original): A reactor according to claim 1, wherein said catalyst layer has a thickness of 10-100 μm.

9. (Original): A reactor according to claim 1, wherein said reactor is made of aluminum.

10. (Original): A reactor according to claim 1, wherein said reactor is made of steel or high-grade steel.

Claims 11-24 (Cancelled):

25. (Previously Presented): A reactor according to claim 3, wherein width of the passages for the flow of process fluid is 0.5-5 mm.

26. (Previously Presented): A reactor according to claim 5, wherein width of the passages for the flow of process fluid is 0.5-5 mm.

27. (Previously Presented): A reactor according to claim 1, wherein the distance between plates, not taking into account the catalyst, is 2.5-20 mm.

28. (Previously Presented): A reactor according to claim 26, wherein the distance between plates, not taking into account the catalyst, is 2.5-20 mm.

29. (Previously Presented): A reactor according to claim 28, wherein said catalyst layer has a thickness of 1-500 μm.

30. (Previously Presented): A reactor according to claim 3, wherein the corrugations or pleats which form said passages for the flow of process fluid are coated at

least partially on both sides with catalyst material.

31. (Previously Presented): A reactor according to claim 3, wherein the corrugations or pleats which form said passages for the flow of process fluid are perforated.

32. (Previously Presented): A reactor for performing a heat-conditioned catalytic reaction in a process fluid, said reactor comprising: plates that are arranged parallel to one another at a distance and that form flat channels with lateral boundary areas that face one another, wherein a portion of said channels contain a solid catalyst and carry a process fluid, and another portion of said channels carry a heat transfer medium in indirect heat contact with the process fluid, wherein said lateral boundary areas are jacket pieces, which form a pressure-resistant cuboid block with said channels, plates, and with collectors for the process fluid and for the heat transfer medium, and

said reactor is capable of operating at process fluid and heat transfer medium pressures of more than 25 bar.

33. (Previously Presented): A reactor according to claim 32, wherein said plates are flat or are provided with grooves or ribs and are coated at least partially with a catalyst on the surface that faces the process fluid.

34. (Previously Presented): A reactor for performing a heat-conditioned catalytic reaction in a process fluid, said reactor comprising: plates that are arranged parallel to one another at a distance and that form flat channels with lateral boundary areas that face one another, wherein a portion of said channels contain a solid catalyst and is in fluid communication with a source of process fluid, and another portion of said channels is in fluid communication with a source of a heat transfer medium and is in indirect heat contact with said process fluid, wherein said plates are flat or are provided with grooves or ribs and are coated at least partially with a catalyst on the surface that faces the process fluid, and

wherein said lateral boundary areas are jacket pieces, which form a pressure-resistant cuboid block with said channels, plates, and with collectors for the process fluid and for the heat transfer medium, and said reactor is capable of operating at process fluid and heat transfer

medium pressures of more than 25 bar.

35. (New): A reactor according to claim 34, wherein each of said channels which contains a solid catalyst is adjacent a channel which carries said heat transfer medium.

EVIDENCE APPENDIX

Not Applicable.

<u>**RELATED PROCEEDINGS APPENDIX**</u>

Not Applicable.